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U. S. DEPARTMENT OF AGRICULTURE.

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Experiment Station Work, LXXII.

Compiled from the Publications of the Agricultural Experiment Stations.

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LIGHTING FARM HOUSES.

SEPTEMBER, 1912.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.
A. C. TRUE, Director.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATION.

EXPERIMENT STATION WORK.[1]

PROMOTING THE GERMINATION OF SEED.[2]

In a bulletin of the New York Cornell Station, H. H. Love and C. E. Leighty call attention to the fact that—

The seed of many species of leguminous plants usually contains a considerable amount of seed that germinates slowly or not at all. Such seed is often referred to as "hard seed." Very frequently there is so much of this hard seed present that germination tests, even when continued for three weeks, give results entirely misleading as to the viability of the sample or lot of seed. When such seed is sown in the ordinary way a very poor stand of plants is usually secured. This is especially true in dry seasons or in regions of light rainfall.

It was found that delayed germination could be practically done away with by treating the seed with sulphuric acid. Such treatment was found to be especially effective not only on clover seeds of various kinds, but also on cotton seed.

Many varieties of weed seeds commonly found in samples of clover or alfalfa seeds were killed by the acid treatment. The germination of other kinds of weed seeds was either benefited by the treatment or was not affected.

In order to determine whether acid treatment of leguminous seeds is necessary, a germination test should be made. If this shows a low percentage of germination and a large amount of hard seeds that are apparently alive, acid treatment will probably be beneficial. The methods of treatment advised are as follows:

For limited quantities of seed.—When there is only a small amount of seed to be treated, such as the seed from a single head of clover or from a single clover plant, amounting to not more than a few hundred seeds, the following method may be employed:

Place the seed in a small homeopathic vial or test tube. Pour on the seed a quantity of concentrated sulphuric acid equal to about five or six times the volume of the seed. Stir the mixture thoroughly with a stirring rod until all seeds are completely coated with the acid. Allow to stand for 15 to 45 minutes at ordinary room temperature, the longer time being necessary if the percentage of hard seed is high. At the end of this time allow water from a faucet to run into the vial or test tube until it is nearly full, then quickly pour the entire contents into the strainer and wash quickly with water. (If this

[1] A progress record of experimental inquiries published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[2] Compiled from New York Cornell Sta. Bul. 312.

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method is followed, it should be done over a porcelain or other acid-resistant sink and the waste acid washed away with water.) Wash for five minutes in running water, or until the seed is entirely free from acid. The seed may be planted immediately, or it may be allowed to dry before planting, the former process being preferable for small lots of seed.

For seed in large quantities of one-half peck or more.—For larger amounts of seed for sowing in fields the following modifications make the above method applicable:

A stone jar of 2 or 3 gallons capacity, or larger, may be used as a receptacle in which to mix the seed and the acid, and a wooden or iron stick (a broomstick is satisfactory) may be used for stirring. The acid may be washed off by pouring the seed and acid into a wooden box whose bottom has been replaced by a screen of proper mesh. After draining a few minutes, water should be poured over the seed, in large amounts at first in order to prevent heating, and this process should be continued until all acid is washed away. For larger amounts of seed, which are to be sown in a seeder, it will be necessary to allow the seed to dry before sowing. This may be accomplished by spreading it out on a floor or other suitable place in a thin layer.

The materials required for the above treatment are—

For clover or other small seeds in limited quantities.—Small homeopathic vials or test tubes that will hold the seed easily and will give plenty of room for mixing with the acid.

Concentrated sulphuric acid, of a specific gravity of about 1.84, and receptacles for same. Either the chemically pure acid or the ordinary dark-colored commercial acid gives the same results.

A needle mounted on a wooden handle, to be used for stirring the acid and seed.

A spatula or section lifter is needed to remove seeds from the strainer and place them into the tubes.

A wire tea-strainer of fine mesh. This will resist the action of the acid for several hundred tests.

Blotters and germinator, or other apparatus for germinating seeds, if the seed is not to be planted in the soil.

For clover or other small seeds in large quantities of a half peck or more.—Stone jars of 2 or 3 gallons capacity or larger.

Acid as above.

A wooden or iron stirring rod. A broomstick is satisfactory.

A strainer made by nailing a fine-mesh iron, copper, or brass screen to a wooden box.

For cotton and larger seeds.—The same apparatus as given above may be used, except that the screen or sieve may be of larger mesh.

COTTON ANTHRACNOSE.[1]

Cotton anthracnose is a widespread and destructive disease. In a recent bulletin of the South Carolina station H. W. Barre reports the results of four years' careful study of this disease, describing its appearance and characteristics, means of dissemination, and control. The disease is due to a fungus which attacks both bolls and seedlings, although it seems to thrive best in the bolls.

[1] Compiled from South Carolina Sta. Bul. 164.

It appears first on the outside of the boll, usually near the tip, as a small dark to purplish colored spot. As the disease progresses the spot gradually increases in size, covering in some cases one-fourth to one-half of the surface of the boll. At any time after such a spot appears, if the weather conditions are favorable, the whole surface of the diseased area is liable to become covered with a moist, pinkish, pasty-looking mass of spores. This pinkish coloration on such surfaces is very characteristic of the disease.

As soon as the disease gains entrance into a boll it spreads very rapidly through the lint and seed. When bolls * * * are cut open the entire inside is usually found to be discolored and rotten. In fact, we frequently find the entire inside of bolls destroyed when there is little evidence of disease on the outside. Bolls which mature before the lint and seed are completely destroyed partly open. In such cases the lint and seed are found to be compact and rotten and frequently covered with characteristic pink masses of spores. Bolls which are not so badly diseased or bolls which become diseased later in their development may mature and open out wide. In such cases, however, the lint is found to be discolored and does not appear as fluffy and white as it does in the healthy bolls.

The disease frequently attacks young seedlings in the field when they are only a few days old.

At this stage the disease attacks the cotyledons or seed leaves and the stem. On the cotyledons it forms irregular diseased areas around the edges. When the weather is cool and moist and unfavorable for the development of the young plants at this stage the diseased areas on the cotyledons encroach upon the healthy tissue until the seed leaves are entirely destroyed. If the conditions are favorable for the development of the young plants, the disease seems to make little progress, and the plants overcome the trouble. In such cases the diseased cotyledons will hang on until two or three pairs of true leaves have formed. The disease remains alive on these seed leaves and other leaves that drop to the ground and on the leaf scars from which such leaves fall. From here it attacks the bolls when they appear.

The most destructive form of the disease on the seedlings occurs on the stems. Where this phase occurs the young seedlings are found to turn yellow and to look sickly. An examination of such plants reveals the fact that the stems are dark colored and diseased. In such cases the disease seems to do most of its damage at or about the surface of the soil. All of that part of the stem which is underground is usually found, however, to be diseased. During cool spells in the spring the stand is frequently entirely destroyed by this stage of this disease. This is especially true when diseased seed are planted.

The anthracnose fungus grows into the seeds while they are still immature and remains alive there until the seeds are planted. If such diseased seeds are planted in less than three years from the time of maturity they produce diseased plants. The fungus does not remain alive in the field more than one year. Diseased seed is therefore the most important factor in the spread of the disease, and seed selection and crop rotation furnish efficient means of controlling the disease. It was found that by careful selection seed free from anthracnose can be secured from a field where the disease is present.

In the experiments reported the disease was gotten rid of by simply going into the field and picking cotton for seed from healthy stalks

and bolls. This method was also followed by a number of farmers, "and in every case where the selections were properly made they got rid of the disease. Seed selection, then, is a simple and effective method of getting rid of the disease."

It appears that the disease has been introduced "through the seed and usually through seed of some supposedly highly improved variety bought from a seedsman at a fancy price. The disease, it seems, has been brought into communities and carried from farm to farm. * * * It must be kept in mind, therefore, that while we are making an effort to get rid of anthracnose by careful seed selection, we must at the same time guard against reinfecting the farms through diseased seed brought from outside."

ASPHALTUM TREATMENT FOR THE PEACH-TREE BORER.[1]

In a recent bulletin of the California station E. L. Morris calls attention to the use of hard asphaltum, grades "C" and "D," for the control of the peach-tree borer. This material was applied early in the spring to badly infested trees from which the borers had been dug.

It was found that a thick heavy coating prevented both the issuance and the entrance of about 95 per cent to 98 per cent of the insects, the degree of efficiency depending upon the thoroughness of the application. Asphaltum does not penetrate, crack, deteriorate, or bind the tree, since it yields to the slightest pressure. Four years of experimenting have not shown the least injury.

The material is applied warm with a brush from 5 inches below to 5 inches above the ground. It is easier to apply two or more coatings than to try to put on more at one time than will adhere firmly. The first coating will harden very quickly and the second can be applied without loss of time. Two coatings are generally sufficient unless the bark is very rough. But in any case a thick, uniform covering is absolutely necessary for the best results.

Borers are seldom uniformly distributed over an orchard. Small blocks of trees here and there may be badly infested and the most of the orchard comparatively free from the pest. In such cases it is not necessary to treat all of the trees with asphaltum, but it is necessary to examine them carefully, for in no other way can the true conditions be known.

A convenient way to handle the asphaltum is to mount an iron kettle on the running gear of an orchard truck and suspend beneath it a sheet-iron apron as a fire box. Keep hard asphaltum in the kettle all the time, so that the melted asphaltum will not get too hot to carry in small containers, and apply directly to the trees.

RAISING AND FINISHING BEEF CALVES ON THE SAME FARM.[2]

The raising of cattle and the fitting of them for market have generally been considered two separate and independent operations, conducted, as a rule, by two different men, each operating inde-

[1] Compiled from California Sta. Bul. 228.
[2] Compiled from Alabama College Sta. Bul. 158.

pendently of the other and not interested in the outcome of the other's operations. The professional cattle feeder has always preferred to buy his feeder cattle in preference to raising them, and he has been interested in the cattle raiser only to the extent of having him supply a sufficient number of animals of proper quality and at a low enough price to enable him to fit them for market with profit.

In recent years, however, as the value of land has advanced, the raising of feeder stock as a distinct industry has been less profitable, especially on the higher priced lands, and consequently there is, in some sections of the country at least, a tendency for the breeder also to fatten his product on his own farm. Of course, no fixed rules can be given as to the profitableness of the one or of the other phase of the beef business. The question as to whether an individual farmer can raise feeder cattle with profit depends in a large measure, other factors being equal, upon the value of his land and the quantity and kind of feed he can produce. In sections where a great percentage of the land is stony, rough, or too steep to cultivate and is adapted to the production of grass, the growing of feeder cattle is profitable. On the other hand, there are many instances where the raising and feeding of the animals on the same farm would bring greater returns in money value, besides adding to the permanent fertility of the land.

Recent cooperative work by D. T. Gray, of the Alabama station, and W. F. Ward, of the Bureau of Animal Industry of this department, in feeding yearling calves, has a direct bearing on the question of raising and finishing animals on the same farm. They state that—

> The farmer who has as many as 30 breeding cows on his farm should make it a rule to fatten their offspring himself; he can seldom afford to sell the calves to the professional feeder. The feeder usually makes money on the process of fattening, and the man who raises calves in sufficient numbers should keep this extra profit at home. Furthermore, the farmer who has from 8 to 12 calves or steers ready for the feed lot will usually find it profitable to buy a sufficient number of feeders to complete the load, and he can then finish all of them on his own farm.
>
> There are many ways of disposing of beef calves or cattle, and the farmer should be watchful to avoid methods by which money might be lost. It is possible to raise beef cattle properly and by selling them improperly to lose money on the business in just the same way that it is possible to raise good apples, potatoes, and peaches and lose money on them when the marketing part of the business is not studied and given proper attention. When beef cattle are bred, fed, and marketed in a scientific and businesslike manner satisfactory profits should be realized.

The first experiment undertaken was to determine the cost of finishing high-grade calves for market on different feeds when the animals were less than 1 year old. Three lots were kept for four months on a basal ration of cottonseed hulls and alfalfa hay. Lot

1, on a supplementary ration of cottonseed meal, made an average daily gain of 1.71 pounds at a cost of 6.22 cents per pound; lot 2, with cottonseed meal and corncob meal in the proportion of 2 to 1, made an average daily gain of 1.76 pounds, at a cost of 6.19 cents per pound; lot 3, with cottonseed meal and corncob meal in the proportion of 1 to 2, made a gain of 1.83 pounds, at a cost of 6.83 cents per pound. The third lot gave a larger percentage of dressed weight and sold for a better price, but not for enough more to pay for the extra cost of feed.

To determine whether calves can be fattened profitably for the spring market on a feed of cottonseed meal. cottonseed hulls, and mixed pea-vine hay, 52 calves were divided into two lots, one lot receiving the shelter of a good barn and the other fed in the open; but as it was found that the young calves would not thrive during the winter months without shelter, the entire lot was placed in sheds. During a period of 112 days the average daily gain for the entire lot was 1.24 pounds, at a cost of 6.97 cents per pound. Each calf netted a profit of $3.50.

A test was made in wintering calves and fattening them the following summer on pasture. Thirty-four calves were wintered on cottonseed meal and hulls, corn chop, and alfalfa hay. The average daily gain was 1.13 pounds, at a cost of 8.63 cents per pound. On March 25 they were turned on good pasture and in 89 days made an average daily gain per head of 1.33 pounds, at a cost of 4.84 cents per pound. The profit for each calf was $1.86.

Among the conclusions drawn from the above experiments are the following:

A farmer may expect to obtain a reasonable profit on beef calves when he raises and fattens them on his farm and sells them when they are 12 to 14 months old. * * * In the South, at least, in Alabama, at the present time, the calves should be born during the early spring months. * * * Young calves can be finished for the market at a profit on cottonseed meal, cottonseed hulls, and pea-vine hay, but it is more profitable to introduce corn-and-cob meal to take the place of part of the cottonseed meal. * * * The tests seem to indicate that it is more profitable to feed a heavy ration and sell the calves at the end of the winter months, when the prices are normally high, than to hold them until the early summer months.

OPEN-SHED FEEDING OF STEERS.[1]

As a result of seven years' experiments at the Pennsylvania station the conclusion has been reached that an open shed, boarded up closely on three sides and kept well bedded at all times, is more efficient for fattening steers than the basement of a barn.

During the winter of 1909–10, the cattle fed in an open shed made more rapid gains, attained a higher finish, sold for 15 cents per hundred more, and re-

[1] Compiled from Pennsylvania Sta. Bul. 112.

turned 11.6 cents more for each bushel of corn consumed than similar steers fed in the barn. They also required less labor in feeding, and more straw was used in bedding. Results of previous work show that cattle which are fed in groups of 10 or 12 each, with ample room at mangers and troughs, make more satisfactory gains than similar cattle tied in stanchions. This indicates that the methods which require the least amount of labor are the most satisfactory in the feed lots.

A point to be especially emphasized in this connection is that in climates as severe as those under which the above experiments were made the roof and three sides of the open shed should be as nearly absolutely closed as it is practicable to make them, not permitting drafts through the shed or admitting air except from the open side, which should preferably face to the south.

PROFITABLE SYSTEMS OF DAIRY FARMING.[1]

Not infrequently farmers, proceeding under the assumption that efficient cows will determine the success of the dairy herd, attempt to go into dairying by simply introducing cows on a farm without changing the crops raised. That serious loss may attend such a system of farming is shown by W. J. Fraser and R. E. Brand in a recent circular of the Illinois station. They point out that profitable dairying "depends not only on efficient cows, but also on raising crops that contain a maximum amount of digestible nutrients, and especially protein, which is so essential for dairy cows."

A comparison was made of the quantities of nutrients produced annually by four different systems of cropping on 160-acre farms, and from the results thus obtained there was determined the average quantity of milk that can be produced by feeding the crops to good dairy cows under ordinary farm conditions. Although the comparison was made for Illinois, it is believed that the results apply equally well elsewhere.

The crops raised and the rotation practiced under each system are as follows:

System No. 1 was an eight-year rotation of corn, oats, corn, oats, timothy, pasture, pasture, pasture, with 38 acres each of corn and oats, 19 acres of timothy, and 57 acres of pasture.

The rotation and crops of system No. 2 were corn, corn, corn, oats, clover, clover and timothy, pasture, pasture, with 57 acres of corn, 19 acres each of oats, clover, clover and timothy, and 38 acres of pasture.

In system No. 3 the rotation and crops were corn, corn, corn, oats, clover, pasture, pasture, with alfalfa in the rotation once in eight years, giving 57 acres to corn, 19 acres each to oats, clover and alfalfa, and 38 acres to pasture, with an additional 19 acres, corn ground, sown to rye for pasture.

[1] Compiled from Illinois Sta. Circ. 151.

System No. 4 consisted of corn and alfalfa with rye as a catch crop for pasture, 95 acres being given to corn and 57 to alfalfa. Of the corn ground in this system, 57 acres is sown to rye as soon as the corn is cut, and the cows are on rye pasture two weeks in the fall and 40 days in spring.

The entire farm in each case was figured as tillable and the land as of good quality and well drained. The same crop yields were taken for all systems, the yields being fixed as nearly as possible at the average production per acre on the better class of farms in Illinois. As a basis of production there were taken good-grade cows weighing 1,100 pounds and producing an average of 6,000 pounds of 4 per cent milk a year, when well fed on a balanced ration such as can be produced by systems No. 3 and No. 4.

A comparison of the actual results obtained on practical dairy farms in the intensive dairy region of northern Illinois with each of these systems showed that they may well be taken as samples of the systems in actual practice. The authors' conclusions, therefore, have an important practical bearing and are quoted as follows:

Under system No. 1, 991 pounds of milk were produced per acre. By simply changing the crops raised, but feeding to cows of the same quality, the amount of milk produced in system No. 1 was increased over three times in system No. 4, and the receipts from milk alone were increased from $15.20 per acre in system No. 1 to $48.30 per acre in system No. 4.

System No. 3 produced more than twice as much milk per acre as system No. 1, and was perhaps the system best adapted to the general conditions in the dairy districts of the State to-day.

System No. 4 is the most likely to meet the requirements of the dairyman with a small amount of productive land who wishes to practice intensive methods. Where the land is high priced and sufficient help can be obtained this system will prove the most remunerative if intelligently pursued. On a quarter section of land 84 cows can be kept just as well as 32 cows, and yet have all their feed produced on the farm. It simply depends on whether system No. 1 or No. 4 is used to produce the feed.

Increased returns basis of increased profits.—The small profit shown for system No. 1 means that after all labor is paid for at market prices and the incidental expenses figured as offset by the income from garden, orchard, etc., there is left for profit but $2.43. This means that the dairyman is just able to make a living by this system, and the extras of life must come from the labor returns of the women and children, who receive no remuneration whatever. There are dairy farms in Illinois conducted in this manner that do not pay 5 per cent interest on the investment. And this is not all. The farm is continually running down in producing power, so that smaller and smaller yields are obtained year after year, making this deplorable condition grow gradually worse. System No. 2 has $780 profit; system No. 3, $1,947; and system No. 4, $3,928 profit above interest on the investment and pay for labor, including the proprietor's labor at common wages. If, as is likely to be done on more intelligently conducted farms, better methods of breeding were instituted under systems Nos. 3 and 4, so as to increase the efficiency of the cows, there would be a much larger difference in the total returns than here indicated.

Increased profits not in money value alone.—It should also be noted that while system No. 1 reduces the nitrogen in the soil 1,900 pounds per year and exhausts the humus, the other three systems increase the nitrogen 110, 2,280, and 5,830 pounds, respectively, per year, besides increasing the humus. As nitrogen and humus, because of their scarcity, are already the limiting factors in most soils, system No. 1 is a ruinous practice to pursue, while with systems No. 3 and No. 4 the dairymen are not only making money, but the farm is gradually becoming more productive year after year, so that as time goes on their profits continually increase, provided only that attention be given to depleted mineral constituents. With system No. 4 there is an annual increase of 38 pounds of nitrogen per acre, while with the poorest system there is a loss of 12½ pounds per acre annually. Yet poor as system No. 1 is, it does not compare in depleting the soil with the practice of selling a 55-bushel crop of corn from the land and then burning the stalks, as is so frequently practiced through the corn belt in this day of progressive agriculture. Few yet realize the full meaning of such practices to the future agriculture of our State.

Growing large quantities of legumes, as is done in systems No. 3 and No. 4, not only increases the nitrogen, but if all manure is carefully preserved and applied to the soil the humus will also be increased, and by paying special attention to good tillage the physical condition of the soil will without doubt be greatly improved, making the farm more productive year after year. Without the soil in good physical condition no farm can do its best. There is scarcely a farm in Illinois on which the productive power can not be greatly increased by the growing of more legumes, the intelligent use of manure, and good tillage. Ten cents per acre will replace the necessary mineral constituents removed in the milk by system No. 4, and if twice this amount were applied each year the dairyman would be enriching his soil.

The marvelous differences in the profits derived from these four systems of cropping are best shown by a direct comparison of the profits left by each system. System No. 1 returns $2.43; system No. 2 returns $780, or 321 times the profit of No. 1; system No. 3, $1,947, or 801 times that of No. 1; and system No. 4, $3,928, or 1,616 times the profit of system No. 1, besides adding 5,830 pounds of nitrogen to the soil of the farm. These figures show that an intensive system of dairy farming will rapidly increase the profits and the producing power of the farm, even though all the milk is sold, if the system includes the liberal growing of legumes, the careful saving and applying of all manure, and the addition of a few cents' worth of mineral constituents per acre annually, thus making not only a permanent agriculture, but an accumulative agriculture which at the same time is highly remunerative.

MARKET EGGS AND THEIR IMPROVEMENT.[1]

M. M. Hastings, of the Bureau of Animal Industry, estimates that for every dollar's worth of eggs produced there is a loss of 17 cents, as follows: From dirty eggs, 2 cents; breakage, 2 cents; chick development, 5 cents; shrunken or held eggs, 5 cents; rotten eggs, 2½ cents; moldy and bad-flavored eggs, one-half cent. Such conditions affect the trade in several ways. There is first the producer, who suffers probably the most of all. The price he receives for his products is

[1] Compiled from Ohio Sta. Circ. 118; U. S. Dept. Agr. Yearbook 1910, pp. 461–470; Bur. Anim. Indus. Bul. 141, Circ. 140; Ann. Rpts. Live Stock Assocs. Ontario, 1911, pp. 72–76.

calculated to cover at least a large proportion of shrinkage which the commission man counts on at certain seasons of the year. Again, the shipping of these worthless eggs costs the handlers the expense of transportation and also a very heavy expense by way of the employment of expert candlers to cull out the bad and grade the remainder. The consumer, of course, suffers as well by paying a higher price than he would have been called upon to pay had there been no shrinkage. Besides this direct loss, there is a loss which is less tangible but none the less real; that is the loss due to curtailed consumption. People do not like to buy bad eggs, and if such are served to them they are inclined next time to buy something else. This cuts down the demand and lowers the price.

As pointed out by the Ohio station, the elimination of the present practice of handling eggs by the general stores is particularly to be desired.

The country merchant is after business for his store and he dare not offend a patron by refusing what is offered lest competitors secure the offended customer. His method encourages careless, slovenly habits in caring for the eggs by the producer. He encourages holding the eggs until a quantity can be brought to the store at a time, and is himself guilty of storing the eggs in damp, foul-smelling cellars, resulting in moldy, shrunken eggs of low quality. Through the present methods of marketing the producer not only bears the brunt of his own sins, but he bears as well all those that have attached themselves to his product on the long route between him and the ultimate consumer. It might seem that under the present system the producer is faring very well, considering, as this investigation shows, that he is receiving practically as much for his product at his local store as it brings after it passes through three or four hands and is transported to a distant market. But this advantage is more apparent than real. The farmer who trades his eggs at the country store for goods at a trading price in excess of what the merchant can get for these eggs after shipping them to market should know that the price he is receiving for his product is an artificial one and that the merchant gets the same percentage on the goods he sells whether he pays 16 or 22 cents a dozen for the eggs.

Under present conditions the farmer who markets good eggs to the storekeeper gets the same price as the farmer who brings in the bad eggs. This state of affairs does not tend to encourage the honest producers, nor does it strengthen the bond of union that exists, or should exist, between the producer, the wholesaler, and the consumer. There is therefore a great need for a better and more rational system of marketing eggs.

The work of the Bureau of Animal Industry in Kansas during the summer of 1910 has shown that the loss-off method of buying eggs resulted in a most gratifying improvement in the eggs.

Where this system is in use the eggs as bought are "candled"—that is, subjected to a test which shows quite definitely their condition and quality.

Candling is performed by holding the eggs up to a small hole, about the size of a half dollar, cut in a shield of metal or other material, behind which is a strong light. Usually this light is furnished by an ordinary 16-candlepower incandescent light, but a lamp, candle, or even the sunlight may be utilized. The person candling the eggs is in a dark or semidark room, so that the light shines through the eggs, and when the latter are twirled the condition of the contents is at once revealed to an expert eye. By this test it is possible to detect rots, spots, and other deteriorated eggs, such as shrunken, weak, watery, and heated eggs. In paying for eggs bought on this basis the rots and usually the spots and blood rings are thrown out entirely, so that they become a dead loss to the person responsible for them. Often in buying from the farmer no other distinction is made. The eggs are simply divided into two classes, one of which is good enough to accept and pay for, while the other is rejected and payment therefor is refused. Such a classification is a distinct step forward and results in a great improvement in the eggs.

In some countries, particularly in Denmark, Sweden, Ireland, and South Australia, a cooperative system of handling and marketing eggs and poultry has been in vogue for some time and no doubt has contributed toward the advancement of the poultry industry of these countries. In Canada this movement has also been inaugurated, the different community organizations being known as egg circles. It is stated that in Canada farmers have realized from 2 to 6 cents per dozen more for their eggs than if they had taken them to a local market. A remarkable and unsatisfied demand has been created for circle eggs, and the elimination of unnecessary middle men has resulted in benefit both to producer and consumer.

It is of course apparent that the adoption of an economic system of marketing eggs will not solve all the perplexing problems of poultry management. Careful consideration must always be given to methods of caring for and feeding the flock. The following suggestions on these and other points are made by the Bureau of Animal Industry:

Improve your poultry stock. Keep one of the general-purpose breeds, such as the Plymouth Rock, Wyandotte, Orpington, or Rhode Island Red. Provide one clean, dry, vermin-free nest for every four or five hens. Conclude all hatching by May 15 and sell or confine male birds during the remainder of the summer. Gather eggs once daily during ordinary times and twice daily during hot or rainy weather. In summer place eggs as soon as gathered in a cool, dry room. Use all small and dirty eggs at home. Market eggs frequently—twice a week, if possible—during the summer. In taking eggs to market protect them from the sun's rays. In selling insist that the transaction be on a loss-off basis, for if care has been given the egg this system will yield more money to the producer.

USES OF THE SWEET POTATO.[1]

The food value of the sweet potato is quite fully appreciated. That it has other possible uses of great importance is not so fully understood. For several years the South Carolina Experiment Station has, as reported in previous bulletins of this series,[2] been investigating the possibilities of the sweet potato as a starch producer. In a recent bulletin of the station T. E. Keitt summarizes the results of this work to date. It has been shown to be entirely practicable to make starch of high quality especially suited to laundry and other uses from sweet potatoes. In order to do so, however, it is necessary to have varieties specially suited to starch production. The South Carolina station has made a careful study of a large number of varieties with reference not only to their use for starch production but for other purposes.

It is only by a study of the different varieties that we can determine to what purpose these varieties are best adapted. There are many uses to which the sweet potato may be applied, but in every case the requirements are different, and a potato that is excellent for one purpose may be entirely unfit for another.

For market or for table use early maturity, shape, size, color, texture, flavor, and keeping qualities are all very important factors. The first potatoes on the market, even if not absolutely first class in quality, command a good price; a medium-sized, uniform, evenly colored, fine-textured, sweet-flavored potato is the favorite in the South. At the North the sweet potato that is yellow in color and bakes to a candy is discarded for a white-colored starchy potato; therefore the market requirements of the place of consignment should be closely studied. The potato that can be kept for a long time and sold when scarce is most profitable of all.

For stock-feeding purposes pounds of dry matter per acre is the most important consideration, because the nitrogen-free extract constitutes most of the dry matter, and nitrogen-free extract is what the southern feeder is most deficient in. Cottonseed meal and leguminous forages furnish an abundance of protein, but on account of the lack of enough carbonaceous feed he is constantly forced to feed a narrow ration, which is consequently a high-priced one and one which will not give the best returns for money invested. The color, texture, uniformness of size, and uniformness of shape are of no importance when they are fed to stock. Content of dry matter and yield per acre are paramount.

When potatoes are grown for starch production, a light-colored or white potato is preferable, because the starch is discolored by the coloring matter of the deeply colored potatoes. Percentage composition of starch and yield per acre are the most important factors to consider in this connection, because it is possible to bleach the starch, but deficiencies in composition and yield will cut the profits. For this purpose we would want light-colored, heavy-yielding varieties, high in starch and low in sugar content.

For fermentation purposes for the production of alcohol, a high yield of fermentable carbohydrates and a high yield per acre is all that is necessary.

[1] Compiled from South Carolina Sta. Bul. 163.

[2] U. S. Dept. Agr., Farmers' Buls. 87, p. 26; 334, p. 12.

It matters not how high the sugar content is, for the starch must be converted into sugar before it can be fermented.

The value of the variety tests is twofold; in the first place, we learn which varieties are best suited *for the different purposes, and, secondly, we know* which varieties should be best to use in selection breeding for any particular purpose.

Summarizing the results of the variety tests it is stated that—

For early maturity for table use, Nancy Hall is the best variety that we have tested. It is also a heavy yielder, considering its earliness. Other good table varieties are: Fulleton Yellow Yam, Pumpkin Yam, and Vineland Bunch Yam; the latter, however, is a shy bearer. Of these the Fulleton Yam gave us the best yield.

For stock-feeding purposes the heavy yielding varieties are best suited (probably Nancy Hall could be included on account of its earliness), and some of the following varieties: Brazilian, Southern Queen, Providence, Myer Early, Red Jersey, Molly Malone, all of which yielded heavily, could be planted to form a succession which should last from about August 1 to January 1, after which time the potatoes will be too valuable as a human food, if they can be preserved, to be used as a stock food.

In the manufacture of starch, unless the starch is to be chemically bleached, a white potato is necessary. The other requisites are heavy yield and high starch content. The varieties that would seem best suited are Southern Queen, Providence, and Brazilian, for they are all either white or very light yellow in color, besides being heavy yielders and running high in starch content. Other varieties that yielded high in starch were Myer Early, Strausburg, Red Jersey, and Molly Malone. * * *

In composition the different varieties vary a great deal, and there are certain other influences that seem to produce marked effects on the content of starch. The time of digging is a very important factor, for after the starch content reaches the maximum there is a change to sucrose. This change may take place either in the field or in the storehouse. * * * The best time to dig the crop is after the first killing frost, for then the yield and the starch content are both at their maximum; while earlier, the yield would be less, and later, the starch is partly changed to cane sugar, which is soluble in water, and consequently would be lost in the wash water in the manufacture of the starch.

It is also pointed out that—

The sweet potato might serve as a valuable source of fermentable carbohydrates for the production of alcohol. For, *in addition to its content of starch*, which would first have to be converted into sugars and then fermented, it also contains several per cent of sugars. The sugar content varies with time of gathering. * * * The first wash waters and the pulp might be fermented and the alcohol derived in this way recovered, thus furnishing a valuable by-product to the starch industry.

The sweet potato possesses high value as a stock feed in the South as a cheap and productive source of carbohydrates.

While there would be a great deal of trouble in keeping sweet potatoes the whole year round, and their value at certain seasons, if they are successfully kept, is so great as to be prohibitive of using them as a stock feed, yet they

could be fed judiciously to great advantage from the 1st of September to the 1st of January. And even when there is a good market the scarred ones and culls could be fed to good advantage. All kinds of stock seem very fond of them, and they possess a great advantage over the other root crops, in that they contain as high as 37 per cent of dry matter, and can be depended upon to contain as high as about 30 per cent of dry matter. Besides, sweet potatoes are better suited to our conditions than are most of the other root crops. * * *

On land in [South Carolina] which, under the ordinary system of cropping, yields 20 bushels of corn, we should be able to produce about 200 bushels of sweet potatoes. The potatoes would furnish more than three times as much nitrogen-free extract and as much, or more, of each of the other proximate constituents of a feeding stuff as that contained in the corn.

A South Carolina farmer who has used sweet potatoes for years as a feed for horses, mules, and cattle, says:

"I find them to be a fine feed; of course, it is better not to feed exclusively on them." He continues by saying that he feeds one meal per day of corn and two meals of sweet potatoes, and that during the past fall and winter he fed them every meal for at least three months. He found that his mules, which were being worked to two-horse plows, did good work and kept in good condition. He uses a vegetable cutter to chop the potatoes and finds that 5 or 6 quarts sprinkled with 1 pint of rice meal makes a good feed which is readily eaten by the stock. It is [his] opinion that this rice meal will cause the stock to learn to eat it more readily in the beginning, and that they relish the mixture more than potatoes alone. * * *

In addition to the value of the tubers as a feed, the vines also are highly nutritious and much relished by stock. * * *

The great trouble would be, however, the expense of gathering these vines, which are not only trailing vines, but they take root in many places. On account of the high percentage of fertilizing constituents present and the great need for humus in our soils, perhaps, taking into consideration the cost and difficulties of gathering, it would be best to leave them on the land. If, however, they can be gathered cheaply and are fed on the farm and the manure saved and returned to the land, the feeding would unquestionably be best.

Analysis shows that although they contain about 4 per cent less protein they contain about 1 per cent more fat and 8 per cent less fiber and 11 per cent more carbohydrates than hays of legumes like clover, cowpeas, and soy beans.

The food value of the sweet potato is generally recognized, especially in the South. The South Carolina station has found[1] "that by drying and grinding the dried product into a meal the meal can be preserved indefinitely, and that it does not lose any of its flavor when made into pies and custards."

The culture of the sweet potato is fully described in a previous Farmers' Bulletin of the department.[2]

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[1] See also U. S. Dept. Agr., Farmers' Bul. 169, p. 25.

[2] U. S. Dept. Agr., Farmers' Bul. 324.

VINEGAR MAKING FROM WASTE GRAPES.[1]

Many grapes grown in American vineyards and on farms are unsuitable for shipping, wine making, or drying. A recent bulletin of the California Experiment Station points out that such grapes may be profitably converted into an excellent vinegar. Such vinegar can be sold at a profit and at a price which compares well with that of wine. On the open market wine vinegar can compete with other kinds when quality is considered.

Good vinegar can not be made from moldy grapes or spoiled wine and its manufacture requires as much knowledge and care as that of good wine. Unlike the latter, however, it can be successfully produced on a small scale for domestic purposes. With a few boxes of good grapes and some small casks, vinegar of the best quality can be made for home use, far superior in wholesomeness and palatability to any that can be bought in the general market without paying extravagant prices.

For preparing grape vinegar on a small scale the first thing necessary is a comparatively clean room where an average temperature of 70° F. can be maintained. The apparatus necessary for the preparation of vinegar for home use is as follows:

1. Cask holding about 50 gallons, although if smaller quantities of vinegar are to be prepared barrels having a capacity of 10 gallons and up can be utilized.
2. A wooden spigot.
3. A thermometer.

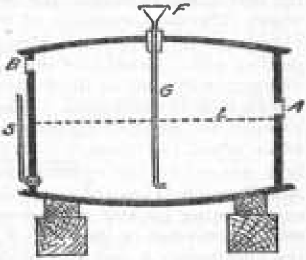

FIG. 1.—Cask for vinegar fermentation.

The cask selected should be arranged and fitted up with the appliances as shown in figure 1. F is a long-stemmed glass funnel fitted with a glass tube G, which reaches nearly to the bottom of the cask. The tube is bent at its lower end at a right angle. In the left head of the cask a hole is bored for the purpose of inserting a cork holding a glass tube bent at a right angle at its lower end S. This tube serves the purpose of a gauge for determining the level of the vinegar or the fluid in the cask. This tube and cork may be removed and replaced at the end of the vinegar-making process by a wooden spigot for the purpose of drawing off the finished product.

A hole for ventilation is bored in each head of the cask, one (A) just above the middle of the right side and another (B) near the top

[1] Compiled from California Sta. Bul. 227.

of the head which contains the tube S. These holes are covered with pieces of varnished metal netting to prevent the entrance of vinegar flies.

Briefly considered, "the manufacture of vinegar from grapes has two distinct stages. First, the alcoholic fermentation by which the sugar is changed into alcohol and carbonic-acid gas. The cause of this fermentation is yeast. Second, the acetic fermentation by which the alcohol is changed into acetic acid. The cause of this fermentation is vinegar or acetic acid bacteria."

After arranging the cask on blocks, as shown in the illustration (fig. 1), from 2 to 3 gallons of good vinegar is placed in the cask through the funnel F (10 per cent of the wine to be fermented). This is followed by the wine heated previously to 85°–90° F. (all grape juice must be converted into wine first), which is added in quantities of one-fourth or one-third of the total amount to be fermented at intervals of one week apart, i. e., if 30 gallons are to be fermented and the division is to be in thirds, 10 gallons are added the first week, 10 gallons the second, and the final 10 gallons the third week. The final quantity of wine must be at nearly the level of the ventilator B. After this the wine-vinegar mixture must remain at perfect rest. Otherwise the acetic-acid bacteria, which produce the vinegar, will sink to the bottom and become inert as far as vinegar production is concerned. When the wine has been converted into vinegar, or, in the language of the vinegar maker, acetification has taken place, the vinegar is drawn off through the spigot, which has been placed in the opening previously holding the gauge glass S. Acetification takes anywhere from one to three months, the time required being greatly dependent upon the temperature, which in all events must not be over 93° F., the supply of air admitted through the ventilators A and B, and the quantity of alcohol in the wine.

Much care must be exercised not to disturb the bacterial film upon the finished vinegar and the sediment. One-tenth of the finished bulk of fluid, i. e., vinegar, must be left in the cask in order to furnish a goodly supply of acetic-acid bacteria for fermenting a new supply of wine. In this way the process can be made a continuous one, and the barrel will have to be cleaned only when the sediment becomes so great that it interferes with the process.

When converting grapes into vinegar there is always a certain amount of loss, some of which can be avoided by working carefully and cleanly. The quantity of vinegar obtained from various kinds of grapes also differs, which is due to the fact that the quantities of stems, seeds, skins, and fermentable sugars vary with each kind of grape.

The following table gives an approximation of the average yield for grapes grown in California which gave a must having a gravity of 20° Balling:

A. Yield of must from 2,000 pounds of grapes:

Theoretical average yield of stems, seeds and stems (pounds)	200
Theoretical average yield of pulp (or must) (gallons)	200
Maximum yield of must in practice (gallons)	140 to 160
Average maximum yield of must (gallons)	150

B. Yield of wine from 150 gallons of must at 20° Balling:

Maximum yield of alcohol, in practice, 47 per cent of sugar=8.78 by weight=11 per cent by volume.

Maximum yield of wine=143 gallons, at 8.78 per cent by weight.

C. Yield of vinegar from 143 gallons of wine of 8.78 per cent alcohol:

Theoretical yield of acetic acid=11.4 per cent.

Maximum yield, in practice, 85 per cent=9.8 per cent.

Maximum yield of vinegar, 135 gallons of 9.8 per cent=63 grains.

One ton of grapes of 20° Balling should, then, on the average yield 135 gallons of vinegar of 9.8 per cent acetic acid.

It is pointed out that although a vinegar of superior quality can be made from grapes, it can not compete in cheapness with that "made from distilled alcohol or the numerous waste products which at present are the source of the main bulk of the vinegar found in commerce."

If wine vinegar is to be produced at a profit, it must be made intelligently and in such a manner as to produce and preserve those qualities to which it owes its reputation for superiority over all other classes of vinegar.

LIGHTING FARMHOUSES.[1]

One of the most important farm-home conveniences is a good lighting system, a system that will do away with the dirt, inconvenience, danger, and inefficiency of the old methods. I. T. Osmond, of the Pennsylvania Experiment Station, says:

With the increasing education of farmers' children and the increasing intellectual and social life in farm homes, the use of artificial light in farmhouses is increasing; and the money economy, but more the sanitary economy, of artificial lighting is of increasing importance. Nor may the aesthetic element, the effect on life of attractive lighting, be left unconsidered.

Four improved lighting systems present themselves, viz, acetylene gas, gasoline, electricity, and kerosene mantle lamps. Alcohol might be considered as a lighting fuel, but at its present price is prohibitive.

The results of comparative tests, made by R. M. West, of the Minnesota Experiment Station, indicate that kerosene burned in a mantle lamp, as compared with acetylene gas, illuminating gas, and elec-

[1] Compiled from Illinois Sta. Circ. 121; Iowa Sta. Bul. 93; Minnesota Sta. Bul. 126; Missouri Engineering Expt. Sta. Bul. 1; Pennsylvania Sta. Bul. 103.

tricity, is economical and efficient, and that a 16-candlepower light may be maintained, giving 17,000 candlepower hours for $1, while to give the same economy alcohol would have to sell at from 3½ to 5 cents per gallon as compared with the price of 59 cents. A kerosene mantle lamp with wick feed can be purchased at from $3 to $4.50, which, according to the above tests, burns satisfactorily with both alcohol and kerosene.

The results of comparative tests of the lighting values of gasoline and alcohol, made by J. B. Davidson and M. L. King, of the Iowa Experiment Station, show that alcohol of 94 per cent purity must be sold at from 11 to 17 cents per gallon to compete with gasoline for lighting purposes at 20 cents per gallon. The gasoline lamp and gasoline gas-lighting systems operate on the same principle, and differ only in that the latter can supply one or several lamps. Gasoline gas when properly mixed with air burns with great heat, and when burned in a mantle lamp heats the mantle to incandescence and gives a good white light. In both of the gasoline systems a few minutes must be taken for generation, during which a small quantity of gasoline is burned in a generator cup, heating the gas supply pipe, which causes the gasoline to vaporize and form a burning mixture very readily. In the gasoline lamps the feed is by gravity or by air pressure, and in the gas generators by air pressure. The gasoline lamps that underwent satisfactory tests at the Iowa Experiment Station were gravity feed lamps, using a clear, pearl-glass chimney and a 4-inch mantle with 3¼ inches of the mantle exposed to heat. A gasoline lighting system is fairly safe when judgment and caution are exercised in its operation. Especial care should be taken to prevent leaks, as gasoline gas is heavier than air and settles in a layer at the bottom of the room, the top of the layer forming a highly explosive mixture with air.

The acetylene gas-lighting system is considered safer and more sanitary. Acetylene gas is a product of the combination of water and calcium carbid. The residue, slaked lime, makes a good fertilizer. Commercial carbid yields from 4½ to 5½ cubic feet of gas per pound, requiring about 0.562 pound of water for complete decomposition. Acetylene gas is colorless, tasteless, lighter than air, and has a pungent odor which easily enables one to detect a leak. It burns with a luminous white flame with no perceptible smoke or odor, and the light, on account of its whiteness, is easy on the eyes and is very desirable for domestic use.

The results of tests made by I. T. Osmond, of the Pennsylvania Experiment Station, show that acetylene is much more sanitary than coal gas, kerosene, or gasoline for lighting, since it takes up less

oxygen from the surrounding air and forms less carbon dioxid per unit of gas burned than any of these three. The acetylene gas machine consists essentially of two parts, the generator proper and the gas holder or gasometer. The gasometer by the rise and fall of its gas bell regulates the quantity of gas generated and also serves as a pressure equalizer supplying the gas to mains at a constant uniform pressure. The carbid is fed into a reservoir of water, thus avoiding uneven generation of heat, which would otherwise result in a poor quality of gas, poor light, and danger. This gas is burned in mantle burners, a good arrangement being to have a set of dry cells forming a circuit with the lamps so as to cause a spark when the gas is turned on, thus automatically applying light.

J. D. Bowles, of the Missouri Engineering Experiment Station, estimates the total cost of an acetylene lighting system for a country home, including fixtures, installation, etc., at about $285, with a total yearly cost of operation of about $67. He also estimates that an installation omitting several of the more elaborate fixtures and handy devices would cost about $225, with an annual cost of operation of about $50. An acetylene gas-lighting system requires judgment and caution in operation for safety and efficiency.

The modern farm electric lighting system, although more expensive, is very efficient and satisfactory. It has an element of safety when properly installed and operated which the other systems do not have. The element of danger which is inherent in high-voltage municipal light plants is eliminated entirely by the low voltage required to operate the number of lights sufficient for the average farm. The farm electric lighting plant consists essentially of a small gasoline engine, dynamo, storage battery, switchboard, transmission wiring, lamps, fixtures, etc. The storage battery can be charged with sufficient energy to run the entire system for at least one night, thereby eliminating the necessity of starting and stopping the engine whenever a few lights are needed. The high cost comes in the storage battery, as one large enough to give sufficient voltage to operate the lamps on a farm is rather expensive. However, the advent of the tungsten lamp has greatly improved the situation, since one of these lamps will produce about three times the candlepower that can be produced by an ordinary lamp with the same amount of electricity, making possible the cheapest kind of plant.

In designing and selecting a system an estimate should be made of the number of lamps and the highest number of lamp hours required. The storage battery should be large enough to a little more than accommodate these lamps, and the dynamo should be of such size as to charge the battery against its own voltage, and must, therefore, be

of higher voltage than the maximum voltage of the battery. The gasoline engine should be large enough to operate the dynamo and cover its own and the dynamo's losses.

As T. H. Amrine, of the Illinois Engineering Experiment Station, states—

The farmer and the resident of the small country town have long felt the need of the electric lamp. They appreciate the adaptability, the cleanliness, and the convenience of this method of illumination and would gladly adopt it in their homes, if possible. However, they live too far from any central lighting station to be able to buy power at a reasonable cost. The private lighting plant has been a possibility, but until recently the cost has been prohibitive for the great majority of people. The present state of development of the storage battery and the wonderful improvements that have been made in incandescent electric lamps during the past year have opened up to residents of the country new possibilities in the way of home lighting by private electric plants.

The introduction of the improved tungsten filament lamp has made it possible to greatly reduce the cost of such plants. Mr. Amrine estimates that a plant having thirteen 25-volt lamps and using a maximum of 35½ lamp-hours daily requires a 15-cell, 40-ampere hour storage battery, giving a pressure of about 39 volts, a one-half kilowatt dynamo, and a 2-horsepower gasoline engine. This system, including all equipment, fixtures, labor of installation, etc., costs about $550 with an average annual cost of operation of $8 to $10. In the installation of such a system the services of a competent electrician should be procured, especially for the wiring, and all apparatus should be carefully tested. Full and complete instructions should be obtained from the various companies for the care and operation of the apparatus supplied by them and these should be carefully followed in the strictest detail, especially in the case of the engine and storage battery. One should soon become acquainted with the ins and outs of his own plant and be able to operate it with the highest efficiency and strictest economy.

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